

Is Gametophyte Sexuality in the Laboratory a Good Predictor of Sexuality in Nature?

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ABSTRACT.—A previous study examined the sexual expression of cultured gametophytes of the Hawaiian endemics *Sadleria cyatheoides* and *S. pallida* grown on mineral-enriched agar. In the present work, we conducted field studies on the sexual expression of natural populations of *Sadleria* spp. gametophytes. Our primary goal was to compare field-collected data to the laboratory-based data of the earlier study to assess if the laboratory data were an accurate reflection of what is occurring in nature. Our results suggested that for generally inferring mating systems operating in nature, agar-based laboratory studies of gametophytes lead to the same conclusions as would observations of field-collected gametophytes. For detailed studies of gametophyte sexuality and development, however, an agar-based medium produces significantly different results than what is found among natural populations, although this may be true for any lab-based study regardless of growth medium. Thus, we suggest caution in the use of agar as a growth medium, and the use of laboratory conditions in general, for studies of fern gametophyte sexual development.

The gametophytes of homosporous ferns possess the ability to be either unisexual (antheridiate or archegoniate) or bisexual. In addition, they may undergo developmental sequences involving changes in sexuality over time due to genetic and/or environmental factors (Klekowski, 1969a; Greer & McCarthy, 1999). Because gametophytes of most species are easy to grow in culture, many studies have been conducted on cultured gametophytes to assess such factors as sexual expression/ontogeny (e.g., Klekowski, 1969b), antheridiogen production and response (e.g., Stevens & Werth, 1999), and populational genetic load/isolate potential (Peck et al., 1990). Numerous studies have employed data from lab-cultured gametophytes to make inferences about mating systems operating in nature (e.g., Soltis & Soltis, 1990, and references therein; Chiou et al., 1998; Li & Haufler, 1999). Although many studies have examined gametophytes that were cultured on mineral-enriched agar, several have employed various natural substrates (Rubin & Paolillo, 1983; Greer, 1993; Pangua et al., 1994; Lindsay & Dyer, 1996; Greer & McCarthy, 1999; see also Dyer, 1979, and references therein). A few studies have combined genetic data from natural populations of sporophytes with laboratory data from cultured gametophytes to assess the relationship between gametophytic attributes and levels and patterns of populational genetic variation (e.g., Haufler & Soltis, 1984; Ranker et al., 1996). Nearly all studies that employ data from lab-cultured gametophytes have at least one assumption in common: that the patterns and processes observed in the laboratory are indicative of what is occurring in nature. At least one study, however, has demonstrated significant differences in the sexual expression of gametophytes